RECURRENT FLOODING ADAPTATION

City of Norfolk
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NORFOLK

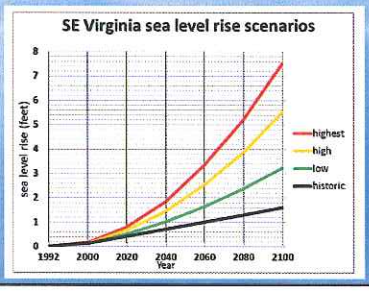
- Culturally Important
  - Hampton Roads & Eastern Virginia
- Commercially and Economically Important
  - Virginia & East Coast to Midwest US
- Strategically and Militarily Important
  - US & Atlantic Alliance/NATO
- Home to ¼ Million Virginians
  - Lives, homes, livelihoods, aspirations

3 FACTS

- Sea Levels Are Rising
  - Cause is not relevant to discussion about adaptation
- Land Is Subsiding
  - Groundwater depletion combined with continued kinetic energy from historic asteroid collision
- Storm Frequency and Intensity Are Both Increasing

Result: More places getting wetter more often

VIMS STUDY SCENARIOS



CHESAPEAKE BAY CRATER

2 COMPONENTS OF RECURRENT FLOODING

- Temporary Flooding
  - Managed Primarily through Floodplain Regulations and Building Codes
  - Familiar to local officials and the public in Virginia
  - Tied to NFIP – height and extent are mapped on FIRM
- Permanent Inundation
  - Unfamiliar new phenomenon in Virginia
  - Extent will depend on amount of net sea level rise

BACKGROUND

- Norfolk has long history of flooding from major storms
- The 1933 Chesapeake-Potomac Hurricane and 1962 Ash Wednesday storms are the benchmark events
- Four major flooding events in past 10 years

1933

1962

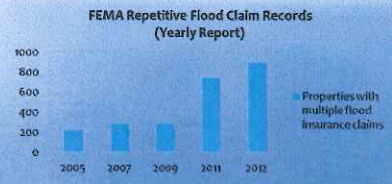
"ROUTINE" FLOODING

But today, basic summer thunderstorms and lunar cycle spring tides can create serious flooding

NORFOLK FLOODING FACTS

- Over 44,000 parcels in Norfolk *today* are at risk of flooding
  - Just under 25% of the land area of Norfolk

REPETITIVE LOSS PROPERTIES



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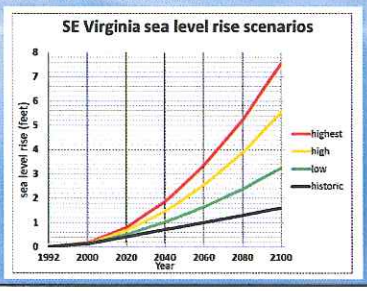

SEA LEVEL RISE INUNDATION IN NORFOLK

- Assuming only 1.5 feet of relative sea level rise:
  - Approximately 5,500 parcels would be underwater entirely or in significant part
  - The assessed value of these parcels is $3.37 billion
- At 3 feet of sea level rise, nearly 20,000 parcels valued in excess of $10 billion are inundated
- Also inundated:
  - 15-130 miles of roadways
  - 110-950 business employing 2,000-15,000 employees
  - 3,500-13,000 housing units with 10,000-36,000 residents
  - 125-250 acres of public parkland and protected open space

NORFOLK APPROACH TO ADAPTATION

Plan & Prepare
- Floodplain Development Standards – Require 3 feet of Freeboard – CRS Participation
- US Army Corps of Engineers Studies
- Secure Commonwealth Panel – Coastal Flooding Sub Panel
- Public/Private Partnerships – Rockefeller Foundation

Adapt
- Brambleton Avenue Improvement Project
- Beach Nourishment & Dune Protection
- Potential Flood Barriers

Communicate
- Web and mobile resources, community meetings, public media, public notification

IMPACT OF ADDITIONAL FREEBOARD

FLOOD GATES & BARRIERS

- Combination of tide gates and flood barriers together with substantial redesign of storm sewer systems:
  - Estimated to cost in excess of $1 billion
  - Will protect about half of the at-risk parcels from inundation

WE NEED TO LIVE WITH WATER

- Adaptations include:
  - Raising roadways and improving drainage systems
  - Improving construction techniques and building codes
  - Relocating critical facilities
- **BUT…What About the Parcels We Cannot Protect?**
  - Would an appropriate process consist of:
    - Identify where the water will be allowed to reclaim the land
    - Develop strategies for graceful retreat to protect public safety and welfare
    - Establish rough timelines based on water levels
- **The time to begin thinking about this is NOW, not when the water is lapping at doorsteps**

ISSUES TO STUDY & CONSIDER

- **Should a Study Commission Look at Options and Alternatives?**
- Some questions to ponder:
  - At what point is it appropriate to stop providing public services to parcels?
  - Is there a time when owners can be told that they must vacate (and remove?) the premises?
  - How much property armoring should a property owner be permitted to do?
  - Are there ways to ease the transition—perhaps through long term amortization or a Transfer of Development Rights type of facility?
  - Who bears the costs of these?
  - As water levels rise, the "Waters of the Commonwealth" extent increases. How will the State manage this?
  - The State-owned Port of Virginia is at risk. How will the Commonwealth handle this?

TAKINGS DOCTRINE

- How does the Takings Doctrine apply?
  - Governmental takings are well resolved Constitutionally, by statute and in the courts
  - The impact of Acts of God – when one-time events – are generally settled with respect to legal ramifications
  - BUT, sea level rise is slowly occurring – what are the Takings Doctrine implications for governmental entities trying to build in resilience while also protecting the public treasury?
    - This is an important issue to work out now while not in a crisis situation
    - A legislative solution may be better than a judicial solution

INSURANCE SITUATION

- Another issue that a Study Commission may consider
  - Flood Insurance through the NFIP is getting more expensive as move toward Congressionally-mandated full actuarial rates
  - Some private insurance providers are pulling out of flood-prone regions
  - Those continuing to cover casualty losses are raising premium rates and increasing deductibles
    - May lead to market-based realignments
    - Owners may be unable to repair damaged structures (from any casualty loss) because of increased deductibles

THANK YOU